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Abstract

This novel empirical study contributes to the literature on the foreign exchange market and financial liberalisation. We examine the determinants of Exchange Market Pressure (EMP) in a panel of forty countries, using a statistical approach to measure market pressure, with particular focus upon the impact of capital controls. We also consider whether EMP is related to a range of other macroeconomic indicators, policy variables and trade openness. We find that capital controls are associated with weaker currencies, especially for advanced countries. Our results are robust to potential endogeneity and different measures of exchange market pressure.

Keywords: Exchange Market Pressure; Capital Controls; Monetary Policy.

JEL Classification Codes: F3, F4.

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1. Introduction

A long standing academic literature has recommended using capital controls to deal with the challenges of financial globalisation, see inter alia Tobin (1978), Eichengreen and Wyplosz (1993), Krugman (1998) and Stiglitz (1999). With the global financial crisis and a recent surge in capital inflows to emerging markets, capital controls are back on the academic and policy agenda, see Baba and Kokenyne (2011), Schmitt-Grohé and Uribe (2012a,b), De Paoli and Lipinska (2013), and Eichengreen and Rose (2014a,b). The former Brazilian Finance Minister Guido Mantega was, for example, a vociferous critic of other countries' competitive devaluations. He went so far as to label them "international currency wars" and responded with a series of controls to avoid the impact upon the Brazilian Real.[3] Brazil is not alone in recently re-introducing controls. Cyprus and Iceland have also implemented different forms of capital controls, see Eichengreen and Rose (2014b). Overall IMF member countries have increased their use of capital controls from 164 measures by July 2012 to 202 measures by August 2013, see IMF (2012, 2013).[4]

Given this context, it is relevant to ask the following questions. What is the impact of capital controls upon the exchange rate? Shall the impact be different across advanced and emerging market economies? And do capital controls matter more or less during crisis periods in the FX market? In principle, controls may be associated with weaker or stronger currencies. Some believe capital controls may counter capital inflows that appreciate the domestic currency, and also fuel a consumption boom and asset price bubbles, see Chamon and Garcia, (2013). In

[3] See Financial Times (2010), Stiglitz (2012), Ostry et al. (2012), Chamon and Garcia (2013) and Table A in the appendix for more details on Brazil's recent experience with capital controls.

[4] Capital controls have always been permissible by the IMF (Gallagher, 2011), but it was surprising that the IMF recently expressed the institutional view that "in certain circumstances, capital flow management measures can be useful," IMF (2012a).

contrast the currency crisis literature has widely documented a link between capital account liberalization and domestic currency stability.[5] The existing empirical literature rejects the hypothesis that capital controls insulate an economy from external shocks. This evidence requires reinvestigation, given the recent revival of capital controls and the earlier literature's limitation that it models FX market pressure using a simple dummy variable approach, see Edwards (2006); Glick et al. (2006); and Glick and Hutchison (2011).

This paper's main objective consequently is to empirically model the main determinants of Exchange Market Pressure (EMP), using measures from Eichengreen et al. (1996) and Girton and Roper (1977). Exchange Market Pressure is the sum of changes in the exchange rate, foreign reserves and/or interest rates. We seek to add to evidence on the effectiveness of capital controls in insulating an economy from destabilising capital inflows. We are unaware of any other studies that evaluate the effects of capital account liberalization on a continuous measure of exchange market pressure, with a large panel dataset of advanced and emerging market economies. Our continuous measure of EMP conveys more information than a simple discrete speculative attack dummy; see Mandilaras and Bird (2008). This paper models capital controls using the Chinn and Ito (2008) Index of capital account openness. Furthermore, a number of control variables are used to evaluate the effects of trade openness, policy regimes and macroeconomic fundamentals. This paper endeavours to account for the potential endogeneity of capital controls and EMP by using Instrumental Variables. Our large panel dataset helpfully allows us to consider whether capital controls have a different impact across advanced economies and emerging markets. Finally, we examine whether crisis periods are especially related to capital control measures by

[5] More generally see Edison et al. (2002) for a survey of literature on capital account liberalization and economic performance.

using Probit analysis for our sample of forty countries. Hence, we contribute to the literature on the FX market and the impact of country characteristics.

This paper proceeds as follows. Firstly, we set out our methodology: our continuous measure of Exchange Market Pressure and the empirical methods used in the paper. In the third section we discuss our panel dataset and present our Instrumental Variable and Probit empirical results. The last section concludes and offers some policy prescriptions.

2. Methodology

2.1 Exchange Market Pressure Index

We begin with a discussion of issues related to our key variable of interest. Our preferred measure of Exchange Market Pressure (EMP) consists of a weighted average of the exchange rate, relative interest rates and foreign exchange reserves. It is sometimes argued that the components of an exchange market pressure index depend on the structure of the economy and therefore, must be derived from a structural macroeconomic model of exchange rate determination. However, structural exchange rate models that link the exchange rate to macroeconomic variables have found it challenging to forecast better than a random walk, see Meese and Rogoff (1983). Due to the controversial nature of exchange rate models, we adopt Eichengreen's et al. (1996) statistical approach to construct an Exchange Market Pressure Index for a panel of forty countries as follows:

$$EMP_{it} \equiv [(\alpha_i \Delta s_{it}) + (\beta_i \Delta(i_{it} - i_{it}^*)) - (\gamma_i \Delta(f_{it} - f_{it}^*))] \quad (1)$$

This exchange market pressure index EMP_{it} for country i at time t is therefore a weighted sum of spot exchange rate changes (Δs_{it}), relative interest rate change $\Delta(i_{it} - i_{it}^*)$ and relative foreign

exchange reserve changes $\Delta(f_{it} - f_{it}^{*})$. Lower case variables have been transformed into logarithmic form and the Greek letter Δ denotes the first difference operator. The spot exchange rate (s_{it}) is defined as the log price of the US$ in domestic currency units. Hence, a rise in s_{it} is a domestic currency depreciation. An asterisks (*) denotes the foreign counterpart of domestic variables.

Modelling exchange market pressure using only exchange rate changes is not enough as monetary authorities may alleviate upward pressure for example by raising interest rate and/or spending foreign exchange reserves. Therefore, interest rate and foreign exchange reserve changes constitute valid components of an exchange market pressure index. An increase in the exchange rate, a rise in interest rate and a loss of foreign exchange reserves imply an increase in exchange market pressure. The parameters α_i, β_i and γ_i in equation (1) are weights assigned to components of the exchange market pressure index and are based on the inverse of their volatilities. This assigns a low weight to more volatile components and thus ensures equal importance of all components. This approach also has the advantage that it is not conditional upon implicit macroeconomic assumptions, for example those made by Girton and Roper (1977) and Weymark (1995). Nevertheless, in our empirical analysis we assess the robustness of our results by also using a measure of exchange market pressure from Girton and Roper (1977).

Girton and Roper (1977), hereafter GR, first used a monetary model of exchange rate determination and derived an exchange market pressure index which is a simple sum of exchange rate and foreign exchange reserve changes. It assigns equal weights to both exchange rate and foreign exchange reserve changes; it does not require the estimation of any model parameters to derive the weights of the index. Roper and Turnovsky (1980) on the other hand,

used a macroeconomic model to derive the trade-off that monetary authorities face between targeting domestic credit and the exchange rate when stabilizing domestic output. The derived exchange market pressure index is the sum of exchange rate and foreign exchange reserves changes. However, both index components are not equally important, requiring the estimation of six parameters to construct these weights. Weymark (1995) also construct an exchange market pressure index based upon a macro-model and requires the estimation of two parameters to assign weights to the foreign exchange reserve component of the exchange market pressure index. In contrast to these studies, Pentecost et al. (2001) used a wealth augmented monetary model and derived an exchange market pressure index which is a simple sum of the exchange rate, foreign exchange reserve and relative interest differential changes. Only one parameter has to be estimated in the construction of Pentecost's et al. (2001) exchange market pressure index. Our empirical work focuses upon the Eichengreen et al. (1996) statistical measure of market pressure, as it accounts for interest rate changes and standardises each component of the index.

The empirical market pressure literature has mainly focused on macroeconomic variables as EMP determinants. Girton and Roper (1977) first examined the determinants of exchange market pressure for Canada. The estimated equation used domestic and foreign monetary aggregates, and domestic and foreign income as exchange market pressure explicators. Connolly and da Silveira (1979) applied the GR model of exchange market pressure to the postwar Brazilian monetary experience. Their single equation approach used domestic credit, foreign prices and domestic income as exchange market pressure determinants. A dynamic GR model was applied to Canada by Burdekin and Burkett (1990) and they used the US and Canadian GDP deflator, and Treasury Bill Rate as EMP determinants. Kim (1985), Thornton (1995) and Bahmani-Oskooee and Bernstein (1999) slightly modified the Connolly and da Silveira (1979)

version of GR and used the money multiplier as an additional independent variable. Wohar and Lee (1992) extended GR and included foreign real income, foreign money supply and foreign interest rate as regressors. Pollard (1999) used Wohar and Lee's (1992) specification and evaluated the effects of net central bank credit as a percentage of high powered money, the money multiplier, foreign money supply, deviations from purchasing power parity, domestic and foreign real income, and the interest rate differential on market pressure. These studies indicate that domestic credit, foreign price, domestic real income, the US Treasury Bill Rate, money multiplier and deviations from purchasing power parity are the main determinants of exchange market pressure. We account for this literature in our results section.

The studies discussed above have evaluated individual country exchange market pressure determinants using time series data. However, Bird and Mandilaras (2006) and Mandilaras and Bird (2008) are multi-country studies and evaluate the determinants of exchange market pressure using a panel approach. The former study focused on the effects of fiscal imbalance on exchange market pressure for East Asian and Pacific and Latin American countries. The latter study examined the relationship between market pressure and the foreign debt burden for Latin American countries. Furthermore, they use monetary aggregates, unemployment and measures of banking system health as control variables. The empirical evidence obtained from these studies show that the budget balance as percent of GDP, fixed and intermediate exchange rate regime, Federal Funds Rate, short term debt, domestic credit and total debt are important exchange market pressure determinants in a panel framework. Following Bird and Mandilaras (2006) and Mandilaras and Bird (2008) we also advocate multi-country panel methods in this context. Next we set out the empirical methods utilized in this paper, which focuses on the relationship between exchange market pressure and capital controls.

2.2 Econometric Methods

We adopt as our benchmark empirical model the Least Square Dummy Variable (LSDV) approach for evaluating the determinants of exchange market pressure in our panel of advanced and emerging market economies. Our benchmark panel model suggests EMP_{it}, for country i at time t, is a linear function of country intercepts, c_i, and a vector of independent variables, x_{it}:

$$EMP_{it} = c_i + \theta x_{it} + u_{it}, \qquad u_{it} \sim IID(0, \sigma_u^2) \tag{2}$$

Where θ is a vector of parameters. The error term (u_{it}) has zero mean and constant variance. Furthermore, it is assumed that all x_{it} are independent of all u_{it}, that is $E[x_{it}u_{it}] = 0$. Our benchmark panel model takes account of country heterogeneity by allowing the intercept to vary across countries, hence taking account of differences in the structure of each economy under consideration. After introducing a dummy variable for each country to denote time invariant heterogeneity in their economies, we write equation (2) as:

$$EMP_{it} = \sum_{j=1}^{N} c_j d_{ij} + x_{it}^{'}\theta + u_{it} \tag{3}$$

However, the introduction of too many regressors in equation (3) renders this regression model unattractive. In order to avoid this problem, we estimate the regression model in deviation from individual means which enables us to eliminate individual effects, c_i. The regression model in deviation form is as follows:

$$\overline{EMP}_i = c_i + \bar{x}_i^{'}\theta + \bar{u}_i \tag{4}$$

Where $\overline{EMP}_i$ is a mean of the dependent variable and is defined as $\overline{EMP}_i = T^{-1}\sum_{t=1}^{T} EMP_{it}$; $\bar{x}_i$ and $\bar{u}_i$ are defined in a similar way. Therefore, having subtracted equation (4) from equation (2), we obtain equation (5) as follows:

$$EMP_{it} - \overline{EMP}_i = (x_{it} - \bar{x}_i)\theta + (u_{it} - \bar{u}_i) \tag{5}$$

Equation (5) is a regression model in deviation from individual means and does not contain individual country effects c_i. The ordinary least square estimate of θ obtained from this transformed model is the fixed effect estimator and is given as:

$$\hat{\theta}_{FE} = \left(\sum_{i=1}^{N}\sum_{t=1}^{T} (x_{it} - \bar{x}_i)(x_{it} - \bar{x}_i) \right)^{-1} \sum_{i=1}^{N}\sum_{t=1}^{T} (x_{it} - \bar{x}_i)(EMP_{it} - \overline{EMP}_i) \tag{6}$$

The use of a fixed effects approach with first differenced data overcomes any potential nonstationarity issues. However, some of the variables used in the estimated exchange market pressure equation may be simultaneously determined. It is possible that pressure on the exchange rate may lead to the imposition of capital controls. Some of the explicators below, for example remittances, the reserve import ratio and real exchange rate, share terms with the dependent variable. Moreover, trade openness could be endogenous through the feedback between trade and financial openness. Aizenman (2003) illustrates that greater trade openness increases the effective cost of enforcing financial repression. Financial openness is thus a by-product of greater trade integration. There could also be reverse causality, because greater financial openness may reduce the cost of trade credit and encourage foreign direct investment, and both may provide incentives to more commercial trade. This result in a simultaneity problem for capital controls. In such a situation, Ordinary Least Squares suffers from bias which can be

avoided using instruments for endogenous variables in the regression.[6] The instruments used must be (a) uncorrelated with the error term, (b) correlated with the endogenous variable, and (c) must not be an explanatory variable in the original regression (Murray, 2006). Two Stage Least Squares is an example of Instrumental Variable estimation. It requires an equal number of instruments and endogenous variables.[7] It is commonly observed that the instrument used for an endogenous variable is weakly correlated with the endogenous variable in question. Using such a variable as an instrument is likely to produce larger standard errors and hence insignificant estimators (Verbeek, 2008).[8]

The final estimator used in this paper is the Probit Limited Dependent Variable approach. We follow Eichengreen et al. (1996) and construct a crisis index using the following criterion: $Crisis_{it} = 1$ if $EMP_{it} > 1.5\sigma_{EMP} + \mu_{EMP}$; and $Crisis_{it} = 0$ otherwise, where σ_{EMP} and μ_{EMP} are the unconditional standard deviation and mean of EMP_{it}. We now go on to discuss the data in the paper and present our results.

[TABLE 1 ABOUT HERE]

[6] Ordinary least square estimation is biased due to correlation between error term and one of the explanators in the regression equation. Such a correlation may result from an endogenous variable, a mismeasured explanator, an omitted explanator or lagged dependent variable among the explanators (Murray, 2006).

[7] The equation is exactly identified when the number of instruments equals the number of endogenous explanators. The equation is overidentified if the number of instruments exceeds the number of endogenous variables.

[8] Two other problems associated with the use of weak instruments are (a) Use of an instrument despite weak correlation between endogenous variables and instrument can lead to inconsistency in instrumental variable estimates, and (b) OLS and IV estimates bias in the same direction in finite sample. As the R^2 between instrument and endogenous variable approaches zero, the magnitude of the IV bias approaches that of OLS (Bound et al. 1995).

3. Results

3.1. Data

This study uses annual data from 1977 to 2012 in a panel of up to forty advanced and emerging market economies. See Table 1 for the list of countries used in this study. To construct our Eichengreen et al. (1996) exchange market pressure index the main source of data are the World Bank's *World Development Indicators* and the International Monetary Fund's *International Financial Statistics*. Capital controls are proxied by the Chinn and Ito (2008) capital account openness index. Chinn and Ito (2008) construct an openness index using data on capital account restrictions reported in the IMF's *Annual Reports on Exchange Rate Arrangements and Exchange Restrictions* (AREAER). Chinn and Ito (2008) construct their index through two steps. Firstly, they assign a dummy variable for four major categories on external accounts such as the presence of multiple exchange rates, restrictions on capital account transactions, restrictions on current account transactions and requirements to surrender export proceeds. Secondly, they construct the index of capital account openness through a standardised principal component. An increase in the index implies increasing capital account openness. Hence, the Chinn and Ito (2008) capital account openness index is a continuous variable and has the advantage that it attempts to measure the intensity of capital controls.

Figure 1. Exchange Market Pressure and Capital Controls

[FIGURE 1 HERE]

Notes: this graph presents Exchange Market Pressure data from Eichengreen et al. (1996) (grey line) and Capital Controls (black line). Data is for Australia, Argentina, Brazil and Spain between 1977 and 2012. A rise in EMP is a rise in FX market pressure (left hand scale). A rise in the capital account openness index is a fall in capital controls (right hand scale). Correlations between EMP and controls for these countries are negative, and range from -0.04 for Spain and -0.36 for Brazil. Australia and Argentina correlations are -0.10 and -0.30 respectively.

Figure 1 presents some indicative graphical evidence to illustrate the relationship between exchange market pressure and capital controls. The figure highlights that capital

account liberalisation has been pursued in the advanced and emerging market economies but there have been reversals in Australia, Argentina and Brazil. Brazil has recently reintroduced capital controls due to capital inflows and a strong Brazilian Real. Brazilian exchange market pressure has subsequently become negative. Overall for these four countries there has been a negative unconditional correlation between EMP and capital controls for our sample period. Eichengreen and Rose (2014a) suggest capital controls are persistent, with little evidence of substantial and frequent changes in controls. Given the high volatility of EMP compared to capital controls, this highlights the need for panel estimation to exploit time series and cross sectional variation across countries, and also to consider additional explicators of EMP.

The data on monetary aggregates is taken from World Bank WDI for all countries except Austria, Canada, Germany, Greece and Spain, which is taken from IMF IFS and OECD statistics. Trade openness data is taken from WDI. Since the number of time series observations used in this study differs to some extent from country to country, our panel data set is unbalanced. See Table B in the Appendix for further details on the data sources used in this paper.

3.2. Empirical Results

This paper uses fixed effects and instrumental variable (i.e. two stage least squares) estimation methods that includes cross section effects for evaluating the determinants of exchange market pressure in a panel of up to forty countries. We then go on to consider Probit estimation using random effects. Our main focus is on the relationship between capital controls (K_{it}) and exchange market pressure (EMP_{it}), but we also consider the exchange rate regime, inflation targeting, trade openness, and other key macroeconomic variables. The most general specification we use in this paper is given as:

$$EMP_{it} = \alpha_i + \beta_1 K_{it} + \beta_2 O_{it} + \beta_3 \Delta q_{it} + \beta_4 Fixed_{it} + \beta_5 Intermed_{it} + \beta_6 IT_{it} + \beta_7 \Delta r_{it} + \beta_8 \Delta m_{it} + \beta_9 \Delta rem_{it} + \beta_{10} \Delta y_{it} + u_{it} \quad (7)$$

$$\beta_3, \beta_8, \beta_9 > 0, \qquad \beta_4, \beta_5, \beta_6, \beta_7 < 0$$

The sign and significance of the coefficient β_1 on capital account openness (K_{it}) is uncertain *a priori* and central to our analysis. The additional determinants of EMP that we consider in equation (7) are: current account openness (O_{it}); the change in the real exchange rate (Δq_{it}); the inflation targeting regime (IT_{it});[9] change in the reserve import ratio (Δr_{it}); change in monetary aggregates (Δm_{it}); change in remittances (Δrem_{it}); and growth in real income (Δy_{it}). The Ilzetzki et al. (2008) coarse index of *de facto* exchange rate regimes is used to construct $Fixed_{it}$ and $Intermed_{it}$, which are dummy variables for fixed and intermediate exchange rate regimes respectively. For a fixed regime, a value of 1 is assigned to no separate legal tender, pre-announced peg or currency board arrangement, pre-announced horizontal band that is narrower than or equal to $\pm 2\%$ and *de facto* pegs. An $Intermed_{it}$ dummy is constructed by assigning a value of 1 to a *de facto* crawling peg, pre-announced crawling peg, a *de facto* crawling band that is wider than or equal to $\pm 5\%$, a moving band that is wider than or equal to $\pm 2\%$ and managed float. See Appendix Table C for further details.

Trade openness has also remained a contentious issue in the empirical literature on EMP. The opponents of trade openness argue that a weakening of a country's export sector reduces the inflow of foreign capital and increases susceptibility to market pressure. Frankel and Cavallo (2008) argued that trade and capital account openness go hand-in-hand, which reduces a country's ability to effectively implement capital controls. Rose (2005) explains that strong trade

[9] We follow Petursson (2004) when constructing our inflation targeting dummy variable.

links reduce a country's default probabilities and hence reduces pressure on the domestic currency to depreciate. Hence, our study also considers the impact of trade openness on exchange market pressure.

[TABLE 2 ABOUT HERE]

Table 2 presents our first set of results on the determinants of exchange market pressure. Column [1] uses fixed effects estimation to take account of unobserved heterogeneity, as set out in equation (6), and the Eichengreen et al. measure of market pressure (EMP1) for both advanced and emerging market countries. There is little evidence capital or current account openness matter for exchange rate pressure in column [1]. In contrast, money is important with fixed effects estimation: an increase in the money supply is associated with an increase in exchange market pressure, consistent with the monetary approach to exchange rate determination. The real exchange rate has a significant and positive link with EMP1. While income, reserves, fixed regimes and remittance have a negative association. However, fixed effects estimation does not account for potential endogeneity. In response to strong exchange market pressure to appreciate for example, a government may introduce capital controls. Hence, we subsequently focus upon a 2SLS Instrumental Variable (IV) with fixed effects estimator in the rest of our analysis.

Table 2 column [2] provides our first IV estimates. While capital controls remain insignificant with IV, the coefficient and t-statistic have increased. Indeed, once we take a General-to-Specific approach and delete insignificant variables in column [3], we find that exchange market pressure is significantly related to capital controls at the 10% level. We also consider whether this result is robust to the Girton-Roper market press measure (i.e. EMP2). For this large panel of countries we find evidence that capital controls are strongly related to market

pressure. In addition, column [5] implies trade openness is related to EMP2. This first set of results suggests that capital controls and trade openness may be important for market pressure. We take account of unobserved fixed effects in Table 2, but there may be differences in responses to capital controls across our broad panel of countries. Hence we next split our panel into advanced and emerging market countries, especially given we have a large number of countries and income may matter for the determinants of EMP.[10]

[TABLE 3 ABOUT HERE]

Table 3 indicates that capital account openness matters for exchange market pressure in advanced economies, when using IV and irrespective of the measure of exchange market pressure. An increase in capital account openness is linked to a reduction in both measures of market pressure. There are two channels through which capital account openness may reduce exchange market pressure. First, market liquidity increases with an increase in international capital flows. An increase in market liquidity in turn accelerates economic growth primarily by boosting productivity growth. Second, the efficiency of the domestic financial sector improves due to the presence of foreign banks, which in turn spurs economic growth (Levine, 2001). Better macroeconomic fundamentals reduce market pressure, a finding consistent with first generation currency crisis models, see Krugman (1979). This is a key result in our paper. In addition, movements in the real exchange rate also are linked to EMP. An increase in the real exchange rate is associated with an increase in both Eichengreen et al. (1996) and Girton and Roper (1976) measures. Trade openness is relevant with a small coefficient for Girton and Roper (1976) EMP

[10] As recommended by the Referee, we also experiment with other measures of financial openness (i.e. capital controls). We considered Quinn and Toyoda (2008) and Dreher (2006, 2015) capital openness measures, since these had reasonable time spans covering our dataset. Therefore, we replicated the results in Table 2 and these also identified a strong link between financial openness and exchange market pressure. See Quinn et al. (2011) for an extensive discussion of different measure of capital account openness.

in column [3] and [4] of Table 3. The reserve import ratio and real income are significant but they have the opposite sign with the two measures of market pressure. Money is unimportant for EMP in advanced economies, possibly since monetary policy has been more prudent for much of our data period and less likely to induce currency difficulties.

Next we consider whether capital controls are equally important for emerging market economies using IV estimation. Table 4 presents mixed evidence on the impact of capital controls on EMP for these countries. There is some evidence of the relevance of capital account openness using the Girton and Roper measure. However, this is only borderline significant at the 5% significance level. EMP2 is also a less complete measure since it does not account for interest rate changes and the components of the market pressure index are equally weighted, unlike our preferred measure from Eichengreen et al. (1996). Table 4 indicates that growth in money aggregates is connected to increasing EMP, consistent with expectations that loose monetary policy weakens the currency. This contrasts with the insignificance of money growth for advanced economies' EMP, affirming their improved monetary conduct. Focusing upon our preferred measure EMP1 in columns [1] and [2] of Table 4, nominal anchors of a fixed exchange rate regime and inflation targeting, and increased levels of reserves are associated with a decline in exchange market pressure in emerging markets.

[TABLE 4 ABOUT HERE]

Finally, we present results from Probit estimation to examine crisis situations in the FX market.[11] Eichengreen and Rose (2014a,b) mention that although they are rare, financial crisis can cause countries to introduce capital controls, for example Iceland in 2008 and Cyprus in

[11] Due to space constraints, we focus upon our preferred Eichengreen et al. (1993) measure of EMP in the Probit analysis.

2013. We use a limited dependent variable to indicate when there are extreme movements in EMP, since these are potentially situations a government would wish to influence by using capital controls. Table 5 column [2] shows that while exchange market pressure in extreme circumstances is negatively associated with liberalization in advanced economies, this is not statistically significant at the 10% level. The level of reserves, real exchange rate and growth rate are most important in a crisis for EMP. Also, emerging market economies capital controls have little statistical connection to EMP. Monetary policy, by way of money growth and reserves, are more important for EMP in a crisis for emerging markets. Hence, we extend the Probit results of Glick and Hutchinson (2011) to both emerging markets and advanced economies, implying that capital controls have little impact in extreme market situations. This suggests that underlying fundamentals are more important for 'extreme' currency movements, possibly because capital controls are more slowly moving than currency crises, see Eichengreen and Rose (2014a).

[TABLE 5 ABOUT HERE]

To summarize our results overall, the negative relationship between market pressure and capital account openness, evidenced in Tables 2, 3 and 4, indicate that an increase in financial openness is linked to a reduction in pressure on EMP, especially for advanced countries. Hence, more open advanced economies, with respect to the capital account, are less likely to experience negative speculative attacks in normal times. It appears beneficial for advanced countries to liberalize their financial sector. For emerging markets, capital account openness seems only to be relevant for the Girton and Roper measure. As the Girton and Roper measure does not cover interest rates and weighs the components of EMP equally, there is some doubt cast on this finding. Other significant determinants relevant for EMP include the real money supply, fixed and intermediate exchange rate regimes, the reserve import ratio and real exchange rate.

Furthermore, strong growth in real income implies strong currencies, a finding consistent with the Balassa-Samuelson hypothesis and first generation currency crisis models that emphasize the importance of sound macroeconomic fundamentals for avoiding speculative attacks. Therefore, countries also have to be cognizant of developments in domestic real income, if they are concerned with avoiding pressure on their currencies. The results for advanced economies confirm earlier empirical evidence that documents a negative relationship between liberalized capital account and the likelihood of currency crisis. In general the estimated coefficients for additional explicators are plausible.

4. Conclusion

An earlier empirical literature provided mixed evidence of the effectiveness of capital controls. This paper utilized the Chinn and Ito (2008) capital account index to measure capital account openness and to consider the consequences of financial openness for the foreign exchange market. Furthermore, we also used continuous measures of exchange market pressure from Eichengreen et al. (1996) and Girton and Roper (1977). The results indicate that capital account openness is an important correlate with our two measures of market pressure for advanced economies. For emerging market economies, capital account openness appears to be relevant for the Girton and Roper measure. Differences in the effects of capital account openness for advanced and emerging market economies may be due to the depth and development of the financial sector, strong checks and balances and the quality of regulatory institutions in advanced countries (Eichengreen and Rose, 2014a). Our results were robust to different measures of capital controls. Other relevant determinants of EMP are the real money supply, real exchange rate, fixed and intermediate exchange rate regime, reserve import ratio and real income. Probit results were less supportive of capital controls than IV. Capital controls appear to be less relevant in

times of acute market stress, which may partly be due to their slow moving nature, see Eichengreen and Rose (2014a). Hence it is important for countries to formulate growth oriented policies and be cognizant of developments in other relevant macroeconomic determinants like money, reserves and the real exchange rate to avoid speculative attacks on their currencies.

References

Abdelal, R., (2007) Capital rules: the construction of global finance. Cambridge Harvard University Press.

Aizenman, J., (2003) On the hidden links between financial and trade opening. *Journal of International Money and Finance,* Vol. 27(3), pp. 372–386.

Baba, C. and Kokenyne, A., (2011) Effectiveness of capital controls in selected emerging market economies in the 2000s.International Monetary Fund Working Paper wp/11/281.

Bahmani-Oskooee, M. and Bernstein, D.J., (1999) Exchange market pressure during the current managed float. *Applied Economic Letters,* Vol. 6, pp. 203–208.

Bird, G. and Mandilaras, A., (2006) Regional heterogeneity in the relationship between fiscal imbalances and foreign exchange market pressure. *World Development Economics,* Vol. 34(7), pp. 1171–1181.

Bound, J. Jaeger, D.A. and Baker, R.M., (1995) Problems with instrumental variable estimation when the correlation between the instruments and the endogenous explanatory variable is weak. *Journal of the American Statistical Association,* Vol. 9, pp. 430-450.

Burdekin, R.C.K. and Burkett, P., (1990) A re-examination of the monetary model of exchange market pressure: Canada 1963-1988. *Review of Economics and Statistics,* Vol. 72, pp. 677–681.

Chamon, M. and Garcia, M., (2013) Capital controls in Brazil: Effective? Discussion paper 606, Department of Economics PUC-Rio Brazil.

Chinn, M.D. and Ito, H., (2008) A New Measure of Financial Openness. *Journal of Comparative Analysis,* Vol. 10, pp. 309–322.

Connolly, M. and da Silveira, J.D., (1979) Exchange market pressure in postwar Brazil: an application of the Girton-Roper monetary model. *American Economic Review,* Vol. 69, pp. 448–454.

De Paoli, B. and Lipinska, A., (2013) Capital controls: a normative analysis. Federal Reserve Bank of New York Staff Report No. 600.

Dreher, A., (2006) Does Globalization Affect Growth? Evidence from a new Index of Globalization, *Applied Economics* vol. 38(10), pp. 1091-1110.

Dreher, A., (2015) KOF Index of Globalisation. Swiss Federal Institute of Technology. [http://globalization.kof.ethz.ch/]

Edison, H.J. and Reinhart C.M., (2000) Capital controls during financial crises: the case of Malaysia and Thailand. Board of Governors of the Federal Reserve System. *International Finance Discussion Paper No.* 662.

Edison, J.H., Klein, M.W., Ricci, L. and Sloek, T., (2002) Capital account liberalization and economic performance: Survey and synthesis. *National Bureau of Economic and Research,* Working Paper no. 9100.

Edwards, S., (1999) How effective are capital controls? *Journal of Economic Perspectives,* Vol. 13, pp. 65–84.

Edwards, S., (2006) Financial openness, currency crises, and output losses. In *Financial Markets Volatility and Performance in Emerging Markets*: by Edwards, S. and M.G.P. Garcia, University of Chicago Press.

Eichengreen, B. and Wyplosz, C., (1993) The Unstable EMS. *Brooking Papers on Economic Activity,* Vol. I, pp. 51–143.

Eichengreen, B., Rose, A.K. and Wyplosz, C., (1996) Contagious Currency Crises: First Tests. *Scandinavian Journal of Economics,* Vol. 98, pp. 463–484.

Eichengreen, B. and Rose, A.K., (2014a) Capital controls in the 21st century. *Journal of International Money and Finance,* Vol. 48, pp. 1-16.

Eichengreen, B. and Rose, A.K., (2014b) Capital controls in the 21st century. *CEPR Policy Insight,* No. 72, June.

Financial Times (2010) Brazil in "currency war" alert. Jonathan Wheatley and Peter Garnham. September 27.

Frankel, J.A. and Cavallo, E.A., (2008) Does openness to trade make countries more vulnerable to sudden stops, or less? Using gravity to establish causality. *National Bureau of Economic Research,* Working Paper No. 10957.

Gallagher, K., (2011) Regaining controls? Capital controls and the global financial crisis. *Political Economy Research Institute,* University of Massachusetts Amherst, Working Paper no. 250.

Girton, L. and Roper, D., (1977) A monetary model of exchange market pressure applied to the post war Canadian experience. *American Economic Review,* Vol. 67, pp. 537–48.

Glick, R. and Hutchison, M., (2005) Capital controls and exchange rate instability in developing countries. *Journal of International Money and Finance,* Vol. 24, pp. 387–412.

Glick, R., Guo, X. and Hutchison, M., (2006) Currency crises, capital–account liberalization, and selection bias. *Review of Economics and Statistics,* Vol. 88, pp. 698–714.

Glick, R. and Hutchison, M., (2011) The illusive quest: Do international capital controls contribute to currency stability? *International Review of Economics and Finance,* Vol. 20, pp. 59–70.

Ilzezki, E., Reinhart, M.H. and Rogoff, K.S., (2008) The country chronologies and background material to exchange rate arrangements in the 21st century: which anchor will hold? [http://www.carmenreinhart.com/user_uploads/ERA-Country%20chronologies.pdf]

International Monetary Fund (2012, 2013) *Annual Reports on Exchange Arrangements and Exchange Restrictions*. Washington DC.

International Monetary Fund, (2012a) The Liberalization And Management Of Capital Flows: An Institutional View. [http://www.imf.org/external/np/pp/eng/2012/111412.pdf]

Kaplan, E. and Rodrik, D., (2001) Did the Malaysian capital controls work? *National Bureau of Economic and Research*, Working Paper No. 8142.

Kim, I., (1985) Exchange market pressure in Korea: An application of Girton-Roper model: Note. *Journal of Money, Credit, and Banking,* Vol. 17, pp. 258–263.

Krugman, P., (1979) A model of balance of payments crises. *Journal of Money, Credit, and Banking* Vol. 11, pp. 311-325.

Krugman, P., (1998) Saving Asia: It's time to get radical The IMF Plan not only has failed to revive Asia's troubled economies but has worsened the situation. It's now time for some painful medicine. *Fortune,* September, 7, pp. 1–5.

Levine, R., (2001) International financial liberalization and economic growth. *Review of International Economics,* Vol. 9(4), pp. 688-702.

Magud, N. And Reinhart, C.M., (2006) Capital controls: an evaluation. *National Bureaeu of Economic Research*, Working Paper no. 11973

Mandilaras, A. and Bird, G., (2008) Foreign exchange pressures in Latin America: Does debt matter? *Journal of International Development*, Vol. 20, pp. 613–627.

Meese, R.A. and Rogoff, K. (1983) Empirical exchange rate models of the Seventies: Do they fit out of sample? *Journal of International Economics*, Vol. 14, pp. 3-24.

Murray, M.P., (2006) Avoiding invalid instruments and coping with weak instruments. *The Journal of Economic Perspectives*, Vol. 2(4), pp. 111-132.

Ostry, J.D., Ghosh, A.R. and Korinek, A., (2012) Multilateral aspects of managing the capital account. IMF Staff Discussion Note 12-10.

Pentecost, E.J., Hooydonk, C.V. and Poeck, A.V., (2001) Measuring and estimating exchange market pressure in the EU. *Journal of International Money and Finance,* Vol. 20, pp. 401–418.

Petursson, T.G., (2004) Formulation of inflation targeting around the world. *Central Bank of Iceland Monetary Bulletin*, 2004/1, pp. 57–84.

Pollard, S.K., (1999) Foreign exchange market pressure and transmission of international disturbances: the case of Barbados, Guyana, Jamaica and Trinidad & Tobago. *Applied Economic Letters,* Vol. 6(1), pp. 1–14.

Quinn, D.P. and Toyoda, A.M., (2008) Does Capital Account Liberalization Lead to Economic Growth?" *Review of Financial Studies*, vol. 21(3), pp. 1403-1449.

Roper, D.E. and Turnovsky, S.J., (1980) Optimal exchange market intervention in a simple stochastic macro model. *Canadian Journal of Economics,* Vol. 13, pp. 296–309.

Rose, A.K., (2005) One reason why countries pay their debts: renegotiation and international trade. *Journal of Development Economics,* Vol. 77, pp. 189–206.

Schmitt-Grohé, S. and Uribe, M., (2012a) Prudential policy for peggers. *National Bureau of Economics and Research*, Working Paper No. 18031

Schmitt-Grohé, S. and Uribe, M., (2012b) Managing currency pegs. *American Economic Review*, Vol. 102, pp. 192-197.

Schmukler, S.J., (2004) Financial globalization: gains and pains for developing countries. *Federal Reserve Bank of Atlanta Economic Review,* Second Quarter. pp. 39–66.

Stiglitz, J.E., (1999) Bleak growth prospectus for developing world. *New York Times,* April 10.

Stiglitz, J.E., (2012) Monetary policy in a multi-polar world. Mimeo, Columbia University.

Thornton, J., (1995) Exchange market pressure in Costa Rica, 1986-92: An application of the Girton-Roper model. *International Economic Journal,* Vol. 9(1), pp. 67–72.

Tobin, J., (1978) A proposal for International Monetary Reform. *Eastern Economic Journal,* Vol. 4, pp. 153–159.

Verbeek, M., (2008) *A Guide to Modern Econometrics*. Third Edition John Wiley & Sons.

Weymark, D.N., (1995) Estimating exchange market pressure and the degree of exchange market intervention for Canada. *Journal of International Economics,* Vol. 39, pp. 273–295.

Wohar, M. and Lee, B.S., (1992) An application of the Girton-Roper monetary model of exchange market pressure: The Japanese experience. *Rivisita Internazionale di Scienze e Economiche e Commerciali,* Vol. 39, pp. 993-1013.

Table 1. List of Countries

Advanced Economies
Australia, Austria, Canada, Denmark, Finland, Germany, Greece, Ireland, Italy, Japan, Korea, Netherland, Norway, New Zealand, Sweden, Singapore, Spain, Switzerland and the United Kingdom.
Emerging Markets
Algeria, Argentina, Brazil, China, Colombia, Egypt, India, Indonesia, Malaysia, Mexico, Nigeria, Pakistan, Philippine, Qatar, South Africa, Sri Lanka, Swaziland, Syria, Thailand, Tunisia and Turkey.

Notes: There are 40 countries in the unbalanced panel dataset between 1977 and 2012. Division of countries into advanced economies and emerging market countries is from IMF *World Economic Outlook* [https://www.imf.org/external/pubs/ft/weo/2014/01/weodata/groups.htm].

Table 2. Exchange Market Pressure and Capital Controls

Dependent	**EMP1**	**EMP1**	**EMP1**	**EMP2**	**EMP2**
Estimator	**FE**	**IV**	**IV**	**IV**	**IV**
Explicator	[1]	[2]	[3]	[4]	[5]
K_{it}	-0.012	-0.065	**-0.123***	**-0.052****	**-0.032****
	(-0.157)	(-0.675)	(**-1.822**)	(**-3.068**)	(**-2.991**)
O_{it}	-0.01	-0.011		**0.004****	**0.003****
	(-1.134)	(-1.184)		(**2.522**)	(**3.105**)
$Fixed_{it}$	**-0.429****	**-0.415***		-0.032	
	(**-1.984**)	(**-1.876**)		(-0.815)	
IT_{it}	-0.237	-0.221		0.007	
	(-1.498)	(-1.318)		(0.245)	
$Intermed_{it}$	-0.098	-0.103		**-0.055***	
	(-0.615)	(-0.630)		(**-1.936**)	
Δm_{it}	**0.781****	**0.760****	**0.892****	**0.318****	**0.343****
	(**2.320**)	(**2.238**)	(**2.737**)	(**5.333**)	(**6.612**)
Δq_{it}	**4.670****	**4.766****	**5.594****	**0.295****	**0.334****
	(**9.214**)	(**9.119**)	(**11.289**)	(**3.224**)	(**4.203**)
Δr_{it}	**-4.443****	**-4.350****	**-3.967****	**0.839****	**0.846****
	(**-13.378**)	(**-12.907**)	(**-13.504**)	(**14.199**)	(**17.916**)
Δrem_{it}	**-0.441***	-0.403		-0.01	
	(**-1.701**)	(-1.537)		(-0.222)	
Δy_{it}	**-2.395****	**-2.354****	**-1.491****	-0.047	
	(**-2.278**)	(**-2.227**)	(**-2.012**)	(-0.253)	
Constant	**0.474****	**0.510****	**0.266****	**-0.534****	**-0.461****
	(**2.828**)	(**2.974**)	(**3.953**)	(**-17.747**)	(**-44.119**)
NT	1119	1091	1358	1091	1343
N	39	39	40	39	40
R^2	0.207	0.205	0.196	0.220	0.255
F-statistic	**27.991****	**26.910****	**63.749****	**29.936****	**89.474****
F p-value	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**

Notes: This table investigates the impact of capital controls upon Exchange Market Pressure measures from Eichengreen et al. (1996) (EMP1) and Girton and Roper (1977) (EMP2). The sample period is 1977 to 2012, for up to 40 Advanced and Emerging Market Economies in an unbalanced panel. Estimation of equation (7) is by panel fixed effects (**FE**) in column [1] and panel instrumental variables (**IV**) with fixed effects (i.e. 2SLS) in columns [2]-[5]. For IV endogenous variables are instrumented by lagged values. Estimation is based upon equation (7). See Table B in the Appendix for a list of explicators. T-statistics are in parentheses (.). Asterisks (**) and (*) indicate that estimated parameters are significant at five and ten percent significance level respectively. *NT* is the number of observations. *N* is the number of countries. We present within R^2. F-statistic tests the joint null of insignificant estimated parameters. F-statistic p-values in square brackets [.].

Table 3. EMP and Capital Controls: Advanced Economies IV Estimation

	Dependent	**EMP1**	**EMP1**	**EMP2**	**EMP2**
	Estimator	**IV**	**IV**	**IV**	**IV**
Explicator		[1]	[2]	[3]	[4]
K_{it}		**-0.210****	**-0.212****	**-0.011****	**-0.012****
		(**-1.964**)	(**-3.150**)	(**-3.107**)	(**-5.043**)
O_{it}		-0.016		**0.003****	**0.003****
		(-1.165)		(**7.148**)	(**7.170**)
$Fixed_{it}$		0.237		-0.001	
		(1.024)		(-0.132)	
IT_{it}		-0.09		-0.005	
		(-0.531)		(-0.883)	
$Intermed_{it}$		0.089		-0.002	
		(0.497)		(-0.264)	
Δm_{it}		0.290		-0.004	
		(0.847)		(-0.395)	
Δq_{it}		**19.117****	**19.408****	**0.436****	**0.440****
		(**15.570**)	(**17.610**)	(**11.012**)	(**11.216**)
Δr_{it}		**-6.886****	**-6.873****	**0.939****	**0.939****
		(**-14.314**)	(**-15.869**)	(**60.571**)	(**61.335**)
Δrem_{it}		0.594		**0.059****	**0.059****
		(1.310)		(**4.030**)	(**4.054**)
Δy_{it}		**-31.298****	**-35.556****	**1.512****	**1.530****
		(**-5.149**)	(**-6.875**)	(**7.716**)	(**8.011**)
Constant		**0.684****	**0.859****	**0.032****	**0.031****
		(**2.686**)	(**5.998**)	(**3.923**)	(**6.128**)
NT		550	645	550	550
N		18	19	18	18
R^2		0.478	0.491	0.893	0.892
F-statistic		**47.642****	**148.881****	**433.94****	**726.784****
F p-value		**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**

Notes: This table investigates the determinants of Exchange Market Pressure measures from Eichengreen et al. (1996) (EMP1) and Girton and Roper (1977) (EMP2). Sample 1977 to 2012 for up to 19 advanced economies in this unbalanced panel. Estimation is by panel instrumental variables with fixed effects. Endogenous variables are instrumented. T-statistics are in parentheses (.).Asterisks (**) and (*) indicate that estimated parameters are significant at five and ten percent significance level respectively. *NT* is the number of observations. *N* is the number of countries. We present within R^2. The F-statistic tests the joint null of insignificant estimated parameters. F statistics p-values in square brackets [.].

Table 4. EMP and Capital Controls: Emerging Markets IV Estimation

Dependent	**EMP1**	**EMP1**	**EMP2**	**EMP2**
Estimator	**IV**	**IV**	**IV**	**IV**
Explicator	[1]	[2]	[3]	[4]
K_{it}	0.029	0.005	**-0.073***	**-0.048****
	(0.179)	(0.042)	(**-1.881**)	(**-1.964**)
O_{it}	**-0.023****		**0.004***	**0.005****
	(**-2.065**)		(**1.660**)	(**2.520**)
$Fixed_{it}$	**-1.115****	**-0.901****	0.022	
	(**-2.911**)	(**-3.631**)	(0.244)	
IT_{it}	**-0.696****	**-0.577****	0.035	
	(**-2.217**)	(**-2.376**)	(0.474)	
$Intermed_{it}$	-0.216		0.009	
	(-0.744)		(0.133)	
Δm_{it}	**2.105****	**2.285****	**0.839****	**0.853****
	(**3.422**)	(**4.164**)	(**5.752**)	(**7.698**)
Δq_{it}	**2.481****	**3.136****	0.181	
	(**4.275**)	(**5.755**)	(1.313)	
Δr_{it}	**-3.476****	**-3.025****	**0.814****	**0.829****
	(**-8.123**)	(**-8.447**)	(**8.016**)	(**10.918**)
Δrem_{it}	-0.494		-0.035	
	(-1.626)		(-0.489)	
Δy_{it}	**-1.901***		-0.064	
	(**-1.730**)		(-0.247)	
Constant	**0.798****	**0.460****	**-1.336****	**-1.002****
	(**2.359**)	(**3.599**)	(**-16.662**)	(**-50.499**)
NT	541	702	541	701
N	21	21	21	21
R^2	0.209	0.189	0.206	0.240
F-statistic	**13.428****	**26.147****	**13.595****	**54.152****
F p-value	**[0.000]**	**[0.000]**	**[0.000]**	**[0.000]**

Notes: This table investigates the determinants of Exchange Market Pressure measures from Eichengreen et al. (1996) (**EMP**1) and Girton and Roper (1977) (**EMP**2). Sample 1977 to 2012 for up to 21 emerging markets in this unbalanced panel. Estimation is by panel instrumental variables with fixed effects. Endogenous variables are instrumented. T-statistics are in parentheses (.).Asterisks (**) and (*) indicate that estimated parameters are significant at five and ten percent significance level respectively.*NT* is the number of observations. *N* is the number of countries. We present within R^2. The F-statistic tests the joint null of insignificant estimated parameters. F statistics p-values in square brackets [.].

Table 5. Probit Estimation of Exchange Market Pressure

Sample	**Full**	**Advanced**	**Emerging**
Estimator	**Probit**	**Probit**	**Probit**
Explicator	[1]	[2]	[3]
K_{it}	0.026	-0.068	0.027
	(0.682)	(-0.760)	(0.473)
O_{it}			
$Fixed_{it}$			
IT_{it}			
$Intermed_{it}$	**0.218****		
	(**2.157**)		
Δm_{it}	**0.561***		**0.862****
	(**1.784**)		(**2.272**)
Δq_{it}	**1.383****	**10.121****	
	(**2.838**)	(**4.349**)	
Δr_{it}	**-2.352****	**-3.994**	**-2.081****
	(**-6.127**)	(**-4.508**)	(**-4.917**)
Δrem_{it}			
Δy_{it}		**-42.283****	
		(**-4.410**)	
Constant	**-1.815****	**-1.355****	**-1.627****
	(**-15.281**)	(**-6.287**)	(**-18.198**)
NT	1385	665	740
N	40	19	21
LL	-314.38	-124.832	-173.207

Notes: Sample 1977 to 2012. This table investigates the determinants of Eichengreen et al. (1996) Crisis Index, using Probit random effects estimation. Values in parentheses (.) are t-statistics. Asterisks (**) and (*) indicate that estimated parameters are significant at five and ten percent significance levels respectively. *NT* is the number of observation. *N* is the number of countries in the panel. *LL* is log likelihood ratio statistic.

Appendix

Table A Recent Brazilian Capital Controls

Date	Restriction	Measure
10/9/2009	Tighten	Tighten Tax of 2 percent on portfolio equity and fixed income inflows
11/8/2009	Tighten	Tax of 1.5 percent on the issuance of depository receipts into local equities
10/4/2010	Tighten	Tax rate raised to 4 percent for fixed income inflows
10/18/2010	Tighten	Tax rate was raised to 6 percent for fixed income inflows
12/30/2010	Tighten	Tax of 2 percent on the cancellation of depository receipts into local equities.
1/6/2011	Tighten	Unremunerated reserve requirement of 60 percent on bank's gross FX positions beyond US$3 billions
3/28/2011	Tighten	Tax of 6 percent on borrowing abroad with maturity below one year
4/6/2011	Tighten	Tax of 6 percent on borrowing abroad extended to maturity below two years
7/8/2011	Tighten	Unremunerated reserve requirement of 60 percent on bank's gross FX positions beyond US$1 billion
7/26/2011	Tighten	Tighten Tax on notional amount of currency derivatives
12/1/2011	Loosen	Tax on portfolio equity inflows eliminated
2/29/2012	Tighten	Tax of 6 percent on borrowing abroad extended to maturity below three years
3/1/2012	Tighten	Restricts anticipation of payments to exporters to one year horizon
3/9/2012	Tighten	Tax of 6 percent on borrowing abroad extended to maturity below five years
3/152012	Loosen	Tax on derivatives set to zero for hedging by exporters (up to 1.2 times exports in previous year
6/14/2012	Loosen	Tax of 6 percent on borrowing abroad restricted to maturities below two years
6/28/2012	Loosen	Anticipation of payments to exporters can be done by financial institutions.
12/4/2012	Loosen	Anticipation of payments to exporters allowed for horizon above one year but below five years
12/5/2012	Loosen	Tax of 6 percent on borrowing abroad restricted to maturities below one year
12/18/2012	Loosen	Unremunerated reserve requirement on bank’s gross foreign exchange position only after US $ 3 billions
6/4/2012	Loosen	Tax on fixed income flows eliminated
6/12/2012	Loosen	Tax on notional amount of derivatives eliminated

Notes: Data are from Chamon and Garcia (2013). All tightening restrictions were announced when the market was closed, and became effective on the following business day. The only exception was the January 6, 2011 unremunerated reserve requirement (URR) on Banks’ Gross FX Positions which only became effective three months later.

Table B. List of Variables and Data Sources

Variable	Source
*EMP*1	Exchange Market Pressure Index from Eichengreen et al. (1996) [IFS]
*EMP*2	Exchange Market Pressure Index from Girton and Roper (1977) [IFS]
K_{it}	Chinn and Ito (2008) Capital Account Openness Index
O_{it}	Trade Openness which is the change in exports plus imports as a % of GDP [WDI]
IT_{it}	Dummy variable capturing inflation targeting monetary policy regime
Δq_{it}	Real Exchange rate constructed by adjusting domestic and foreign price ratio with nominal Exchange rate [WDI]
Δr_{it}	Reserve import ratio [WDI]
Δm_{it}	Monetary aggregate (M2) [IFS]
Δrem_{it}	Workers' remittances and compensation of employees paid [WDI]
Δy_{it}	Real GDP growth [WDI]
$Fixed_{it}$	Dummy variables capturing fixed exchange rate regime, from Ilzezki et al. (2008)
$Intermed_{it}$	Dummy variable capturing intermediate exchange rate regime, from Ilzezki et al. (2008)

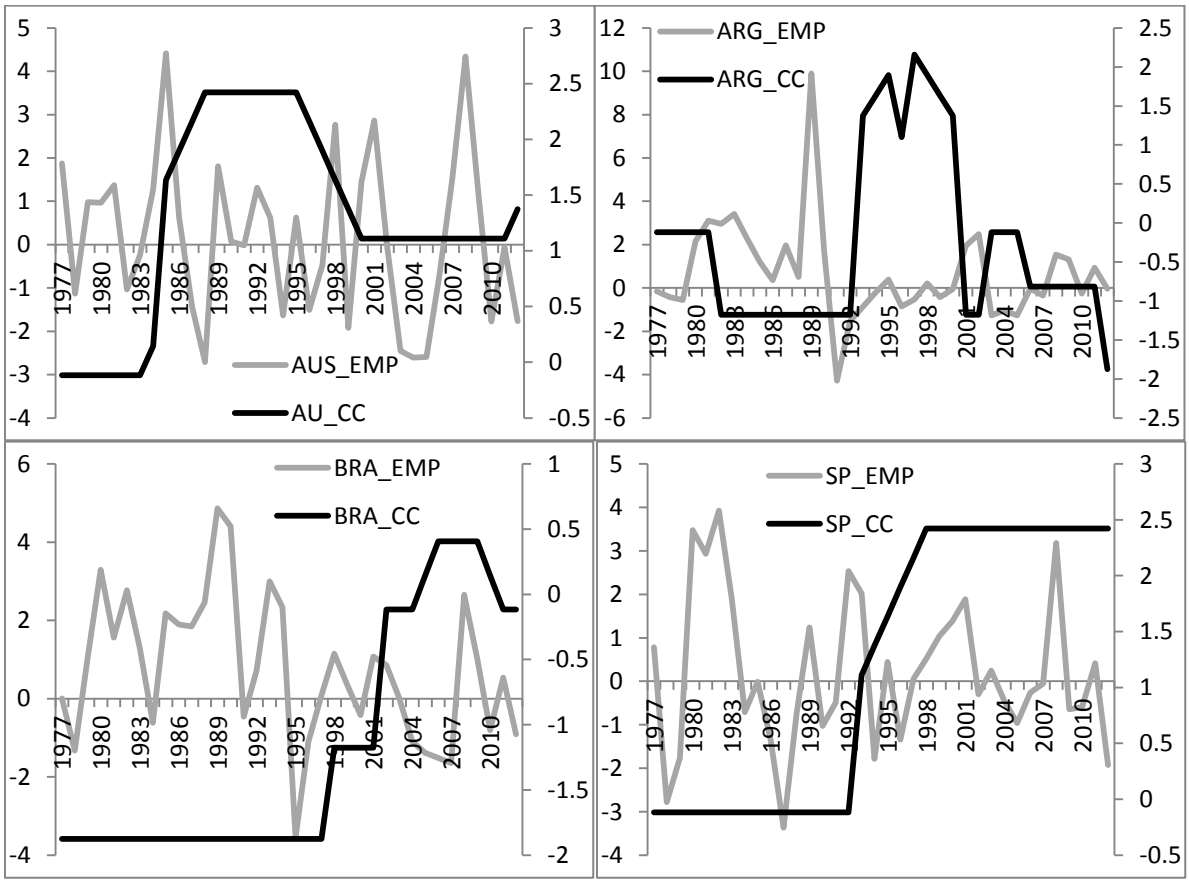
Notes: Data are from IMF *International Financial Statistics* [IFS] and World Bank *World Development Indicators* [WDI]. Δ denotes the first difference operator. The time dimension of this panel of annual data is 1977 to 2012.

Table C. *De Facto* Classification of Exchange Rate Regime

Exchange Rate Regime	Code
No Separate Legal Tender	1
Preannounced peg or currency board arrangement	1
Preannounced horizontal band that is narrower than or equal to ± 2%	1
De facto peg	1
Preannounced crawling peg	2
Pre announced crawling band that is narrower than or equal to ± 2%	2
De facto crawling peg	2
De facto crawling band that is narrower than or equal to ± 2%	2
Preannounced crawling band that is wider than ± 2%	2
De facto crawling band that is narrower than or equal to ± 5%	3
Non crawling band that is narrower than or equal to ± 2%	3
Managed floating	3
Freely floating	4
Freely falling (includes hyperfloat)	5
Dual market in which parallel market data is missing	6

Notes: the source of this data is Ilzezki et al. (2008). Exchange rate regimes are classified from 1 to 6

Figure 1. Exchange Market Pressure and Capital Controls



Notes: this graph presents Exchange Market Pressure data from Eichengreen et al. (1996) (grey line) and Capital Controls (black line). Data is for Australia, Argentina, Brazil and Spain between 1977 and 2012. A rise in EMP is a rise in FX market pressure (left hand scale). A rise in the capital account openness index is a fall in capital controls (right hand scale). Correlations between EMP and controls for these countries are negative, and range from -0.04 for Spain and -0.36 for Brazil. Australia and Argentina correlations are -0.10 and -0.30 respectively.